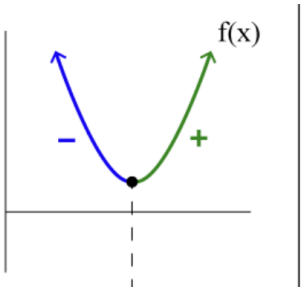
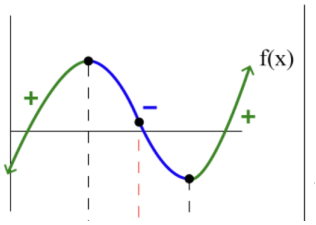
1) Match the function with its derivative.

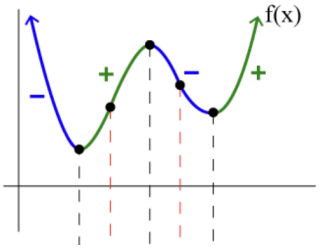
a)



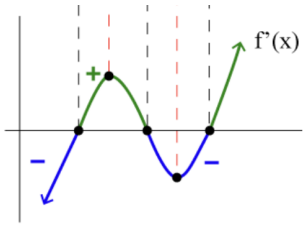
b)



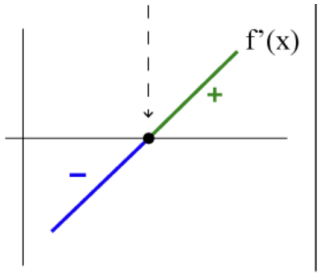
c)



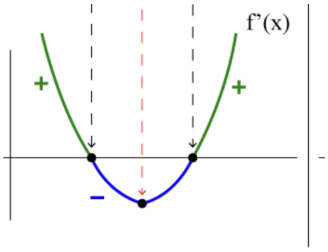
i)



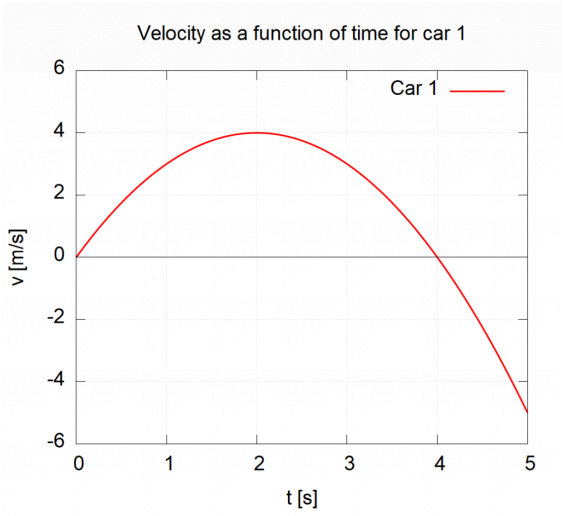
ii)



iii)



2) When is the car speeding up and when is it slowing down?



3) A boat is moving in a river with a current that has speed vw with respect to the shore. The boat first moves downstream (i.e. in the direction of the current) at a constant speed, v_B with respect to the water. The boat travels a distance D in a time t_{Out}. The boat then changes direction to move upstream (i.e. against the direction of the current) at a constant speed, v_B, with respect to the water, and returns to its original starting point (located a distance D from the turn-around point) in a time tIn.
    a) What is tOut in terms of v_W, v_B, and D, as needed?

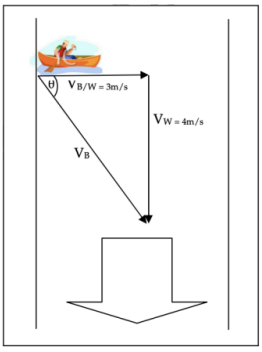
    b) What is tIn in terms of v_W, v_B, and D, as needed?

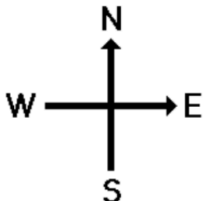
    c) Assuming D = 250 m, t_{In} = 105 s, and v_W = 1.4 m/s, what is v_B, the speed of the boat with respect to the water?

    d) Again, assuming D = 250 m, t_{In} = 105 s, and v_W = 1.4 m/s, what is t_{Out}, the time it takes the boat to move a distance D downstream?

4) A car moves 150.0 m at a 63° "north of east" (this simply means 63° from the x-axis). It stays at rest for a while then moves 300 m at 34° "south of west" (this means 214° from the x-axis). Find the total displacement of the car.

5) A river is flowing at 4 m/sec due south. A boat, whose speed in still water is 3 m/sec, is steered in the direction due east. Find the true speed and direction of the motion of the boat.





6) A stone is thrown horizontally at 8.0 m/s from a cliff 80m high. How far from the base of the cliff will the stone strike the ground?

7) A toy car moves off the edge of a table that is 1.25m high. If the car lands 0.40m from the base of the table how long did it take to hit the floor and with what horizontal velocity was it moving?

8) A little boy pushes a wagon with his dog in it. The mass of the dog and wagon together is 45 kg. The wagon accelerates at 0.85 m/s2. What force is the boy pulling with?

9) A crate is dragged across an ice covered lake. The box accelerates at 0.08m/s2 and is pulled by a 47N force. What is the mass of the box?

10) A student moves a box of books by pulling on a rope attached to a box. The student pulls with a force of 185N horizontally. The box has a mass of 35.0kg, and the coefficient of kinetic friction between the box and the floor is 0.27. Find the acceleration of the box.

11) A 5-kg object is sliding to the right and encountering a friction force which slows it down. The coefficient of friction between the object and the surface is 0.1. Determine the force of gravity, the normal force, the force of friction, and the acceleration. (Neglect air resistance)

12) What force is necessary to stretch an ideal spring with a spring constant of 120 N/m by 30 cm?

13) A spring stretches 8.0 cm when a 13 N force is applied. How far does it stretch when a 26 N is applied?

Phys100 equation sheet

$$\vec{v} = \frac{d\vec{x}}{dt} \qquad \vec{a} = \frac{d\vec{v}}{dt}$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$\vec{v}_{A,C} = \vec{v}_{A,B} + \vec{v}_{B,C}$$

$$\vec{F}_{net} = m\vec{a}$$

$$F_W = mg$$

$$f_s \leq \mu_s N$$

$$f_k = \mu_k N$$

$$|F_{spring}| = k|\Delta x|$$

$g = 9.81\ m/s^2$